R & D facts

U.S. Department of Energy
National Energy Technology Laboratory

Sequestration

06/2002

Carbon Sequestration Science

CONTACT POINTS

Dr. Curt M. White
Carbon Sequestration Science
Focus Area Leader
412-386-5808 phone
412-386-4806 fax
curt.white@netl.doe.gov

Diane (DeeDee) Newlon
Technology Transfer Manager
304-285-4086
r diane.newlon@netl.doe.gov

ADDRESS

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4604 fax

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4469 fax

WEBSITE

www.netl.doe.gov/products/r&d/

Description

The goal of the Carbon Sequestration Science focus area is to identify and remove technical barriers and reduce costs associated with sequestration of carbon from energy processes. Effective carbon sequestration technologies and methods will provide long-range options for reducing CO_2 emissions from large stationary sources of CO_2. These reductions will ensure the continued availability of low-cost energy from the plentiful fossil energy resources within the United States.

Research at the Carbon Sequestration Science Laboratory will emphasize CO_2 separation and capture technologies, geological storage science, development of direct ocean storage approaches, and integrated process modeling, simulation and economic assessment. This research will stimulate innovation and develop novel concepts for carbon sequestration by partnering with universities, Federal laboratories, and private industry. Activities will span the broad carbon sequestration interest area and will focus on improving scientific understanding of the separation and capture of CO_2, the disposal of CO_2 in the deep oceans, and geologic sequestration.

As a part of this national research activity, the focus area for Carbon Sequestration Science will conduct research ranging from fundamental studies to small-scale proof-of-concept research on selected processing options. Systems analysis via computer modeling and simulation of approaches to carbon sequestration will be developed in-house for use in evaluating the various approaches.

The purpose of the Carbon Sequestration focus area at the NETL is to serve as the focal point for all carbon sequestration R&D activities performed with in-house resources sponsored primarily by the Office of Fossil Energy. Its specific role is to:

- Identify research directions and construct a balanced portfolio of activities integrated with the national sequestration R&D program,
- Conduct portions of the R&D portfolio with in-house resources,
- Serve as a hub for the conduct of systems analysis on sequestration technology options.

Carbon Sequestration Science

Benefits

- Generate ideas and build expertise
- Refine program focus as promising approaches emerge
- Provide scientific basis to define and develop pilot-scale activities
- Strengthen existing partnerships
- Facilitate regional NETL/University/Industry partnerships
- Increase participation in key international activities

Goal

Our goal is to have the Carbon Sequestration Science focus area, including its partners, recognized as the premier research laboratory in the area of carbon sequestration. This will be accomplished by:

- Providing scientific insights that lead to technological options for long-term stabilization of CO_2 and other GHG's,
  - provide scientific basis for sequestration to allow continued use of fossil energy resources,
  - develop scientific understanding of processes for separation, capture, reuse, and storage of CO_2 and other GHG's, and,
  - address geological, chemical, and biological sequestration barrier issues.
- Ensuring full attention to potential consequences of sequestration options,
- Providing scientific information and systems analysis from a non-conflicted perspective.

A continuing investment in this focus area will result in the identification of CO_2 capture technologies and sequestration methods that are technically feasible, environmentally acceptable, and economically well defined. Should national decisions be made regarding the need to sequester CO_2, then the capture and sequestration techniques developed as a result of this R&D activity can be deployed commercially in the U.S. and abroad.

Milestones

- In FY2001, the low and high-pressure water tunnel laboratories will be completed. Determine the fate of CO_2 in the ocean water column; evaluate microbes in coal seams; develop simulation models of CO_2 displacement of coal-bed methane; evaluate the effect of ground water pH on coal seam sequestration capacity; and study formation of metal carbonates during reaction of CO_2 with minerals high Ca and Mg.
- In FY2002, the Capture and Geologic Storage laboratories will be completed. Determine the influence of minor flue gas constituents on hydrate formation; study the effects of coal variability (e.g., rank) on sequestration capacity; optimize parameters for CO_2 or multipollutant wet scrubbing; and evaluate the potential for using high volume waste materials (e.g., FGD sludge and fly ash) in sequestration.
- In FY2003, capture and storage research activities will be initiated and work to install the Integrated Carbon Sequestration Test Facility is initiated. Complete the coal seam simulation model (including trace gas components); investigate acid mine drainage (AMD) waters (high in metals content) as a sink for CO_2; evaluate the use of standard pipelines to transport flue gas to sequestration sites; evaluate the effect of trace amounts of SO_2 and NOx on corrosion of CO_2 pipelines and identification of initial capture technologies for joint scale-up Federal/ partnership evaluation.
- In FY2004, assembly of the Integrated Carbon Sequestration Test Facility continues. A novel dry-scrubbing process is investigated for CO_2 removal from simulated Vision 21 gas streams; verify simulation model with experimental results; and improve the kinetics of CO_2-mineral sequestration reactions.
- In FY2005, testing of promising process concepts will be initiated in the Integrated Carbon Sequestration Research Facility. Develop universal flow equations for injection of CO_2 into geologic formations; and evaluate biological and microbiological effects of CO_2 disposal in ocean.